Optimus Generator

Optimum generator - programming for

dose setting and APR programming

There should always be the best correlation between image quality and density with the lowest dose possible for radiographic and image intensifier systems.
Dose limits and the required image quality should always meet the local requirements.
Such requirements can easily be fulfilled by programming the optimum at all dose relevant menus.
This makes it easy to get the APR programmed to have the best customer satisfaction from the application point of view.

Only dose relevant settings are mentioned (in the order of their appearance).

Radiography

Auxilary settings

> Program
> Registration Devices
> RGDVx

Data Set A

Syncmaster present (e.g. grid contact):

Yes **Must** be "Yes" for all moving grid auxilaries.
!!! A "No" will lead to an instantaneous release of the exposure on the grid still standing
!!! but released at the same time. In the worst case this can lead to a second exposure
!!! if the grid contact closes right at the end of the first exposure.
!!! This can most likely be the case for exposures in a range of about 100ms.
No For systems without moving grid like Trauma Diagnost or MCS (Mobile Cassette Stand).

Bucky format density correction (6% steps):

+/- 8 6% steps possible, only at sensing systems.
No function with manual collimators.
Steps to be programmed: See "Density steps".

Dose measurement input:

EZX21 = Chamber 1 \
EZX22 = Chamber 2 \
EZX31 = Chamber 3 selection of chamber input, data at "Dose Rate Control" + "Amplimat"
EZX32 = Chamber 4 /
EZX41 = Chamber 5 /

Dose measurement sensor type:

Bucky amplimat For all radiography 3 field chambers (table + wall bucky, MCS).

Scopo amplimat For all single-field chambers (e.g. Trauma Diagnost) to prevent the side field selection (only release 3 generators).
Such setting is not possible at release 2 generators. If the generator provides a decade adaptation unit WA program the ready decade WAX11 or 12. The decade pin connection 1-2 which activates the side field selection remains open.

Release delay (automatic techniques):

enable **Must** be "enable" for all auxilaries using automatic techniques.
A very short moment before the exposure starts a process takes place at DRC (dose rate control) to be prepared for the dose signal once kV start.
"enable" should be programmed in any case as the generator switches automatically to "disable" if manual techniques are selected.

disable **!!** Should **never** be programmed. It leads to incorrect exposures and sometimes to
!! premature exposure termination during automatic exposures.
!! A correct density alignment is not possible with "disable".

> Program
> Registration Devices
> RGDVx

Data Set B

Tube power factor [%]:

Should always be at 100%. Every reduction influences the kV dependent focus load.
Reductions for special applications should mainly take place at individual APR settings.

kV steps:

Doseequivalent	One dose equivalent +/- step equals one 25% density step.
Single	+/- 1 kV steps. According to customers desires.

mAs steps:

Steps at 6 / 12 / 25% possible (default 25%).
12% recommended if the film speed is equal or faster than 400.

mA steps:

Steps at 6 / 12 / 25% possible (default 25%).
12% recommended if the film speed is equal or faster than 400.

time steps:

Steps at 6 / 12 / 25% possible (default 25%).
12% recommended if the film speed is equal or faster than 400.

Density steps:

Steps at 6 / 12 / 25% possible (default 12%).

Remark: All auxilaries should get the same step rate, the difference in step rate is not possible under normal conditions. A "1◢" can be a step of 6, 12 or 25%.
Pushing and holding the + or - button until it comes to the limit value one can see the programmed step rate: Max ± "4◢" = 25%, max ± "8◢" = 12%, max ± "16◢" = 6%.
To get a + or – 12% step displayed at the desk 2 steps + or – 6% have to be programmed. It requires 4 steps at 6% for one 25% step.
SCP- and MedioCP - generators have a fixed step rate of 12%. Adjacent rooms should get the same step rate programmed.

Density correction (6% steps):

A density correction offset can be programmed for each auxilary. The steps have to be programmed according to the "Density Steps" setting.

This offset influences all settings and all APR for this auxilary.

It should always be zero, at least until the dose and density alignment has been carried out.
Density corrections should be carried out at the individual APR.

Measuring chamber and film-screen-combination programming

> Program
> Dose Rate Control
> Amplimat

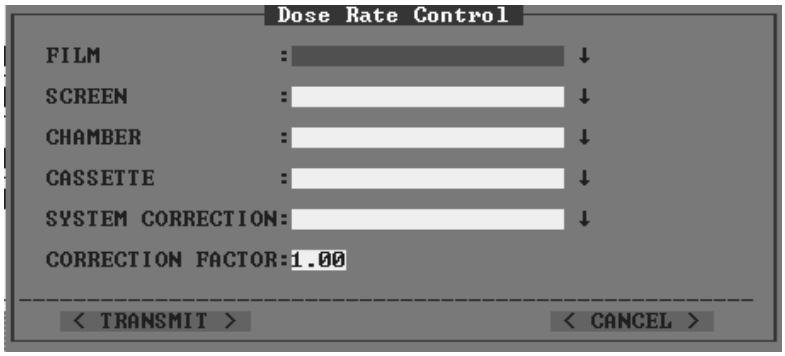
Sensitivity

low	see Attachment A page 12
high	see Attachment A page 12

Chamber x
Data Set x

The screen

appears only if XRGSCOPE has been started with the PC hardkey + password.
Otherwise, or if <**OK**> was given**,** one gets the input screen:



Step by steps all fields must be filled ...

FILM	type of film **!!** film and screen must be of the same color
SCREEN	type of screen or use **LUMAT_LG**.TDL for luminous groups
CHAMBER	installed chamber type
CASSETTE	type of cassette
SYSTEM CORRECTION	kV dependent correction "no corr.(ISO9236-1)" is the normal selection which will not change the kV dependent programmed factors of screen and chamber. "low-kV-correction" should be selected to prevent density increments below 70kV
CORRECTION FACTOR	Correction factor for the density alignment. Allows the alignment of the desired density if the PC hardkey is not present.

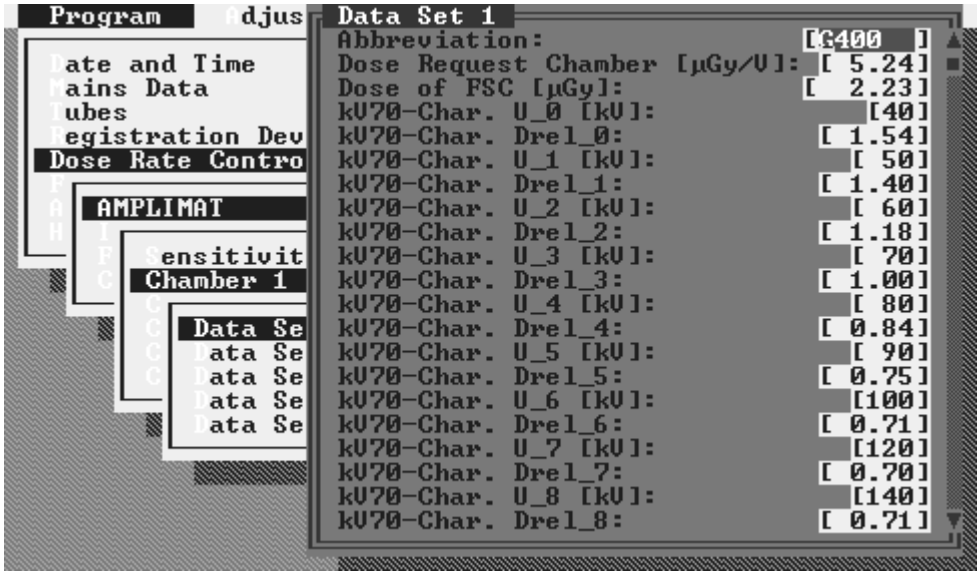
$$\frac{\text{desired density}}{\text{measured density}} = \text{new value "CORRECTION FACTOR"}$$

... and transmitted with <F2>.
Film-screen combinations (FSC's) with their default abbreviations are visible and can be selected on the control desk after generator warm-start.
Special settings for digital cassettes (e.g. PCR) see attachment F pages 18+19

Chamber x
Data Set x

If the screen

appears and the <CANCEL> or <ESC> key is used one gets the following data screen:



Only two fields should be changed in this screen:

Abbreviation: Up to 6 characters can be entered. The default name is the one taken from the SCREEN.TDL file representing the screen color and its speed class. In case there are two FSC's with identical names it is recommended to change one of the names. The difference between either selection cannot be recognized, a wrong selection by mistake can lead to different densities.

Dose of FSC [µGy]: The switch-off dose value for the desired density entered in this field should be almost equal to the measured one.
At considerable deviations: See Attachment A page 12.

desired density
---------- • "Dose of FSC" = new value "Dose of FSC"
measured density

Remark:

The value "**Dose Request Chamber [µGy/V]:**" must be the same at **all** data sets for a chamber. If the programmed values at "Dose of FSC" deviate from the measured ones, the wrong type of measuring chamber might have been programmed. In such a case the entire data set has to be re-programmed to get the kV characteristic values of the installed chamber.
Typical values of the chamber types: See Attachment B page 13.

If the same cassette will also be used at other chambers **(only chambers of the same type !!)** of the system, the data screen can be saved on the disk with <F3> and can be re-loaded to a "Data Set" of the other chamber with <F4> once this data set screen is open.
Afterwards one just has to align the "Dose of FSC" value.

Programming of limit values

> Program
> Application Limits

X-Mode Limits

Limit values can be defined for all available techniques. Some values look as if they are out of limit which they are indeed, but there are additional basic limit values programmed in the generator firmware. These are exposure technique dependent.

As an example the field of the "Falling Load" technique:

X-ray Mode:	AEC falling load kV
Min. Time Limit [ms]:	[1.00]
Max. Time Limit [ms]:	[60000.00]
Min. Current Time Product Limit [mAs]:	[0.001]
Max. Current Time Product Limit [mAs]:	[580.000]

Min. Time Limit [ms]: Is always 1ms for all non-AEC (Automatic Exposure Control) techniques. Exposures with AEC might be switched shorter than 1ms.

Max. Time Limit [ms]: Basic limits are technique dependent and can not be changed or increased:

AEC falling load		kV	4000ms
AEC fixed current		kV-mA	4000ms
TDC (tomo density control)			6000ms
	/	kV-mA-ms	16000ms
free techniques	‹	kV-mAs	16000ms
	\	kV-mAs-ms	16000ms

Min. Current Time Product Limit [mAs]: The smallest mAs - product is 0.5mAs.
AEC exposures with less than 0.5mAs are possible.

Max. Current Time Product Limit [mAs]: The default mAs - product is 580mAs for all AEC-techniques.
850mAs is the absolute limit at which the generator in always terminates.
!! Local limits have to be taken into consideration.

Thoravision Limits

There are default mAs-limits programmed to prevent over-saturation of and memory effects on the selenium drum.
These limits should only be modified by the local application according to the typical average patient size.

Programming of APR with XRGSCOPE

Loading and saving of APR should only be carried out with the help of APRMAN.
It is less time consuming and more convenient to maintain customized APR.
Therefore no details are given at this place for APR work with XRGSCOPE.

> Program
> Human Interface
> APR Data Set

Select APR Data Set

The number of the selected and highlighted APR appears. It is a random number assigned during the loading process and is of no significance.
Exception: See SMI Bucky TH systems and assignment of external APR, e.g. Scopomat.

Change APR Data Set

Displays the data set screen of the highlighted "Select APR Data Set" number.
Detailed explanations appear in chapter APRMAN. The table Attachment D pages 15+16 explains the field names which are slightly different.
The use of APRMAN is much easier.

Correction factors for automatic technique Tomography Density Control (TDC)

> Adjust
> Dose Rate Control

TDC Amplimat

Amplification gain
TDC

The factors have been evaluated as the best in long test series..
A modification of parameters is not recommended.

Display of the AEC and TDC density voltage

To check the dose ramp and the exposure termination threshold using an oscilloscope one can get the threshold value = density voltage for all automatic exposures:

> Faultfind
> Logging Table
> X-Ray Log
> Dose Rate Control Logging

AEC

AEC Calculation

The exposure termination setpoint is the value of **"U_off"**.
Oscilloscope screenshot: See Attachment C picture 1 page 14.

TDC

TDC Calculation

The exposure termination setpoint is the value of **"U_off"**.
Oscilloscope screenshot: See Attachment C picture 2 page 14.

Fluoroscopy

This part explains the additional settings used for fluoroscopy..

Tube limits

> Program
> Tubes

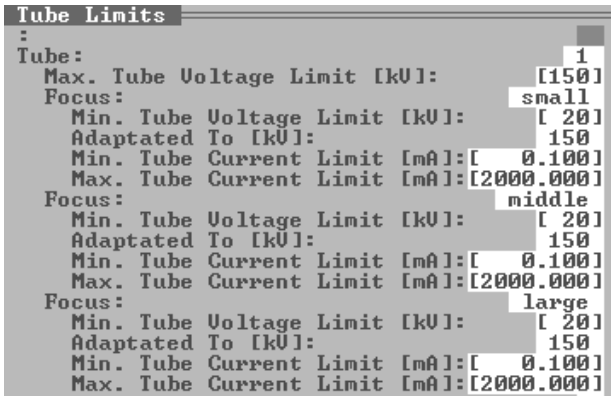
Tube Limits

The smallest emission current

Min. Tube Current Limit [mA]:[0.100]

is default 100µA.

It should not be modified, a different limit might influence the programmed fluoro curve parameters.


Tube Limits
:
Tube: 1
Max. Tube Voltage Limit [kV]: [150]
Focus: small
Min. Tube Voltage Limit [kV]: [20]
Adaptated To [kV]: 150
Min. Tube Current Limit [mA]:[0.100]
Max. Tube Current Limit [mA]:[2000.000]
Focus: middle
Min. Tube Voltage Limit [kV]: [20]
Adaptated To [kV]: 150
Min. Tube Current Limit [mA]:[0.100]
Max. Tube Current Limit [mA]:[2000.000]
Focus: large
Min. Tube Voltage Limit [kV]: [20]
Adaptated To [kV]: 150
Min. Tube Current Limit [mA]:[0.100]
Max. Tube Current Limit [mA]:[2000.000]

Auxilary settings

> Program
> Registration Devices
> RGDVx

Data Set A

Cone density correction (6% steps):

+/- 8 6% steps can be programmed.
Steps to be programmed : See "Density steps".

Dose measurement input:

EZX21/22/31/32/41

any of them can be taken for "Scopo amplimat".

EZX41

Must be selected for "Photo sensor/ampl.inp." to allow DSI series with non-automatic techniques. All other inputs allow automatic only.

Dose measurement sensor type:

Scopo amplimat

For serial changer chambers. The density voltage will be calculated by the data sets of the programmed chamber..

Photo sensor/ampl. inp.

To be programmed for image intensifier auxilaries. The density voltage is automatically set to 1V (similar to density step 25 at SCP /MedioCP; 25 • 40mV = 1V), see "Image Intensifier".
!! Remark: At tomo on image intensifier using TDC see remarks **Attachment E** page 17.

Medium II format kV corr. (dose equiv. steps):	8	dose-equivalent steps possible
Medium II format density corr. (-6% steps):	8	6% steps possible
Medium II format mAs corr. (-6% steps):	8	6% steps possible
Small II format kV corr. (dose equiv. steps):	8	dose-equivalent steps possible
Small II format density corr. (-6% steps):	8	6% steps possible
Small II format mAs corr. (-6% steps):	8	6% steps possible

> Program
> Registration Devices
> RGDVx

Data Set B

Dose relevant settings similar to radiography.

Image Intensifier programming

> Program
> Dose Rate Control
> Amplimat

Sensitivity

low	see Attachment A page 12
high	see Attachment A page 12

Image Intensifier

The default data screen
ii (BV) lead time [ms]:
is programmed to an II lead time of 0.3ms (see system manual).
The exposure will be terminated prior to the regular time (all techniques) by the value of "lead time".

The value of
ii density voltage correction: [1.00]
must remain at 1.00 Volt
(equals 25 density steps SCP,
25 • 40mV = 1V).

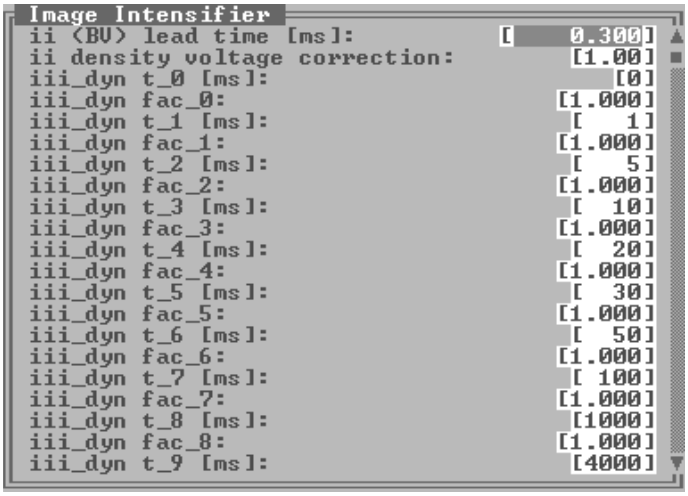


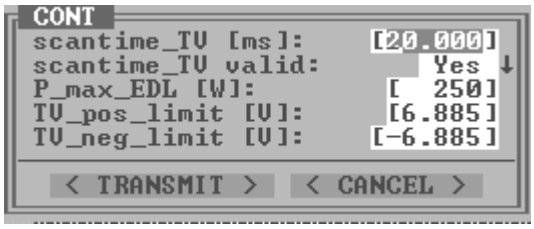
Image Intensifier
ii (BV) lead time [ms]: [0.300]
ii density voltage correction: [1.00]
iii_dyn t_0 [ms]: [0]
iii_dyn fac_0: [1.000]
iii_dyn t_1 [ms]: [1]
iii_dyn fac_1: [1.000]
iii_dyn t_2 [ms]: [5]
iii_dyn fac_2: [1.000]
iii_dyn t_3 [ms]: [10]
iii_dyn fac_3: [1.000]
iii_dyn t_4 [ms]: [20]
iii_dyn fac_4: [1.000]
iii_dyn t_5 [ms]: [30]
iii_dyn fac_5: [1.000]
iii_dyn t_6 [ms]: [50]
iii_dyn fac_6: [1.000]
iii_dyn t_7 [ms]: [100]
iii_dyn fac_7: [1.000]
iii_dyn t_8 [ms]: [1000]
iii_dyn fac_8: [1.000]
iii_dyn t_9 [ms]: [4000]

All other factors have no effect to the system behavior, but should not be changed..

CONT

At systems with different SID's (e.g. EasyD and D76), the max patient entrance dose should not increase a certain level.
The alignment of this limit takes place by adjusting the

"P_max_EDL [W]:" value.



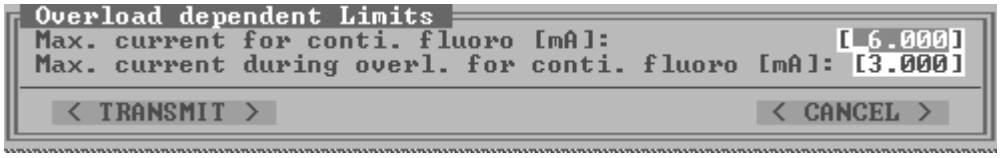
> Program

Fluoroscopy Curves

There are 20 storage screens to fill them with fluoroscopy curves. Three default curves are offered in the file FLUOCURV.TDL, the characteristics of the curves are given at chapter FAULT FINDING page 3Z-12. First one has to assign the default curves from the file to any of the memories. Afterwards the assignment of the memory number to each individual APR has to be carried out. Fluoro curve 1 = memory 1 is default at each APR.

> Program
> Application Limits

Overload dependent Limits

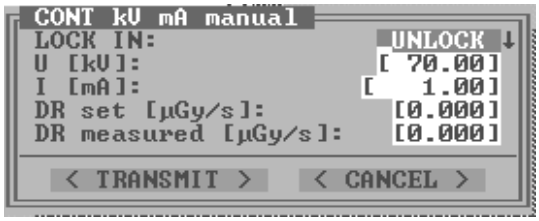


The max emission current of fluoro should not increase the max patient entrance dose depending on the system geometry.
If the temperature switch opens due to the hot oil in the housing the max fluoro emission current will be reduced to 3mA.

> Adjust
> Dose Rate Control

Cont kV mA manual

To align the II - entrance dose the field "LOCK IN" must be changed from "UNLOCK" to "LOCK".
At both fields "DR set" and "DR measured" the same value (e.g. 0.3) has to be entered.
Release fluoro, type in the measured value and keep the set value, transmit the screen.
The generator calculates the new fluoro emission current, it can be seen after opening the screen again.



APR programming with APRMAN

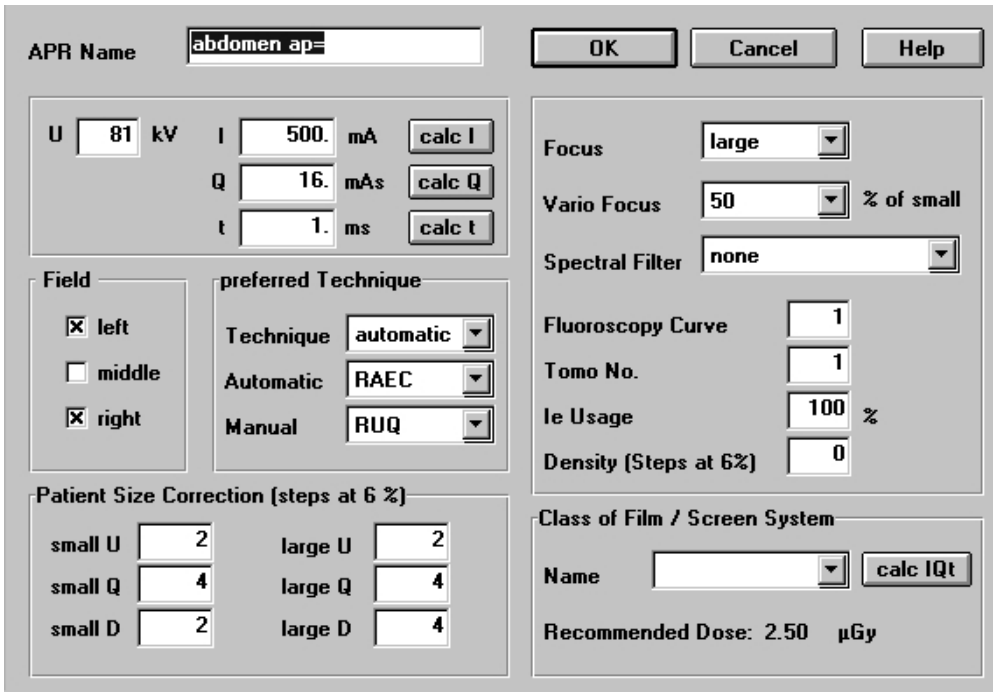
At this point all basic settings and the dose alignment should be complete.

Now the APR programs can be prepared before they are loaded to the generator.

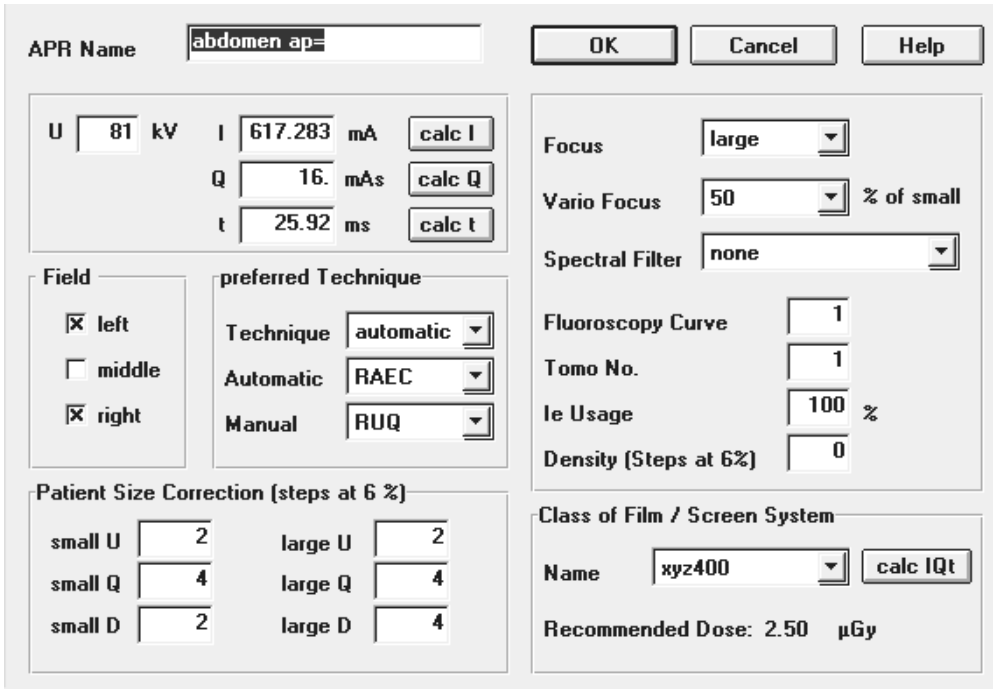
A lot of parameters can be programmed for each APR.

Apart from the parameters which are important for the preferred technique and which are visible at the control desk other parameters are also necessary to get a complete data set.
These background data are required for supervision functions as well as for alternative use in case of functional problems of the generator.

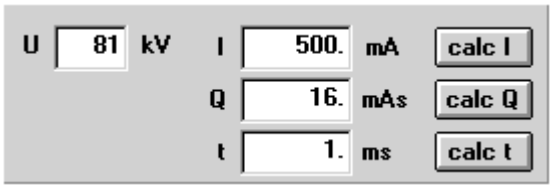
Example of a default APR, which has not been loaded to a generator:

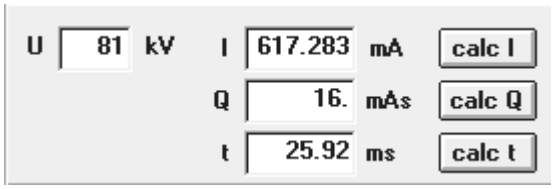


After loading and recalling the same APR screen looks like that::

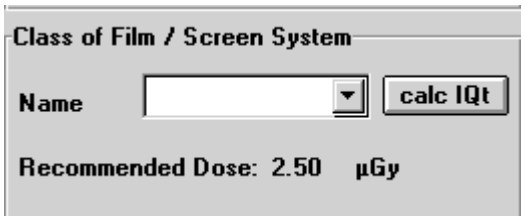


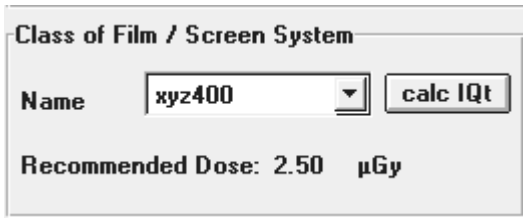
The default data will be calculated technique, generator, tube type and focus dependent..
kV- and mAs-values remained the same in this example, the emission current and the exposure time have been calculated by the generator.



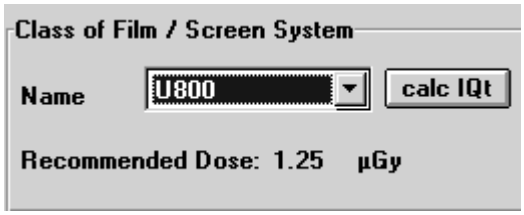


The default 16 mAs based on the film-screen speed class of 400 (Recommended Dose 2.5µGy) did not have to be modified as the generator provides a 400 speed system (xyz400).
The assignment of film-screen combination data sets to the APR takes place by the **"Abbreviation"** name first if the same name has been assigned to the APR data sets before loading.
If not the film-screen combination data set which **"Dose of FSC"** value is the closest to the **"Recommended Dose" value** will be assigned to the APR.





If a default APR data set will be assigned to the only existing FSC of the generator the organ dependent mAs of the APR program might not match the FSC speed system.
In case there is only a 800 speed system with a **"Dose of FSC"** setting of 1.25 µGy the APR screen will look like that:



The default value "Recommended Dose" will be overridden, but the organ dependent mAs will not automatically re-calculated (here: 16mAs for 400 speed).

This has to be carried out with the help of APRMAN.

One reason to adapt the organ mAs to the FSC speed is that the customer shall be able to use the system in case of Amplimat problems. Then the parameters in the background should meet the dose requirements of the film.

A second and major reason is the AEC fault exposure detection.
An explanation can be found in the generator manual chapter FAULT FINDING pages 3-58, 3-59 , 3Z-20 and 3Z-22.

Since the Bucky TH systems are delivered with Release 5.x of the Bucky Controller it requires a "=" character at the end of the APR label if the exposure shall be carried out with grid (cassette tray type dependent).
If APR from an earlier system shall be used in a new system as well the "=" character has to be added to the PAR name. The instruction is at Attachment G page 20.

Attachment A

Software programming "Sensitivity" and hardware "gain factor" settings on-board of EZ150 must always match.

Only combinations
1) EZ150 W4-3 (= gain factor 1) and "Sensitivity = low"
or
2) EZ150 W4-1 (= gain factor 4) and "Sensitivity = high"
must be programmed.

Combination 1) can be used for film-screen-combinations up to a speed class of max 800.
- More sensible systems are possible, but especially using TDC (tomo density control) can cause trouble due to the low density voltage and the small signal which has to be controlled.
- This combination must be used if at least one film-screen-combination is of a low speed class, e.g. 100 or less.

Combination 2) shall be used if the lowest speed class is 200.

Explanation for the selection of **combination 1)**:
A level of 10 Volts DS_MC_SG (dose measuring chamber signal) to the signal input of **DRC** (dose rate control) hardware on-board of CU (central unit) shall never be increased.
An exposure with a 100 speed **FSC** (film-screen-combination) cassette requires 10uGy. With a chamber sensitivity of 5.24uGy/V one gets a density voltage U_off of

$$\frac{\text{film dose}}{\text{chamber sensitivity}} = \frac{10\text{uGy}}{5.24\text{uGy/V}} = 1.91\text{V} = \text{U\_off}$$

If the basic density of the FSC is 1.0 and shall be set to e.g. 1.3 according to customers wishes one gets a density voltage U_off of 2.48V.
If the "gain factor" on EZ150 will be set to 4 the 9.92V density voltage level is almost at the limit of 10V.
Every additional + density correction leads to a density voltage saturation and the exposure can possibly not be terminated. The result might be a black film.

Two other combinations of hard- and software settings are possible. The system will work without problems, but values which are programmed do not match with measured dose values. Maintaining APR using APRMAN will also cause error messages (see next page).

Combinations leading to problems and faulty values:
12) EZ150 W4-3 (= gain factor 1) and "Sensitivity = high"
or
21) EZ150 W4-1 (=gain factor 4) and "Sensitivity = low"

Faulty 12) **DRC** expects a 4 times higher chamber signal at the input. As it comes in non-amplified the exposure termination takes place 4 times later.
To achieve the proper density the value "Dose of FSC" must be divided by 4 and the value is 4 times smaller compared to the measured one.

Faulty 21) **DRC** expects a non-amplified chamber signal. Due to the 4 times amplification the exposure termination takes place in 1/4 of the normal time. The "Dose of FSC" value must be multiplied with 4 to achieve the proper density, but the value is 4 times the measured one.
This leads to error messages working with APRMAN as the "Dose of FSC" values might increase 20uGy.

Correction for 12) The value "Dose of FSC must be multiplied with 4.
Depending on the FSC speed systems the "gain factor" is set to 4 **or** the "Sensitivity" is set to "low".

Correction for 21) The value "Dose of FSC" must be divided by 4.
Depending on the FSC speed systems the "gain factor" is set to 1 **or** the "Sensitivity" is set to "high".

The dose adjustment does not have to be carried out again afterwards as all modified factors are linear.

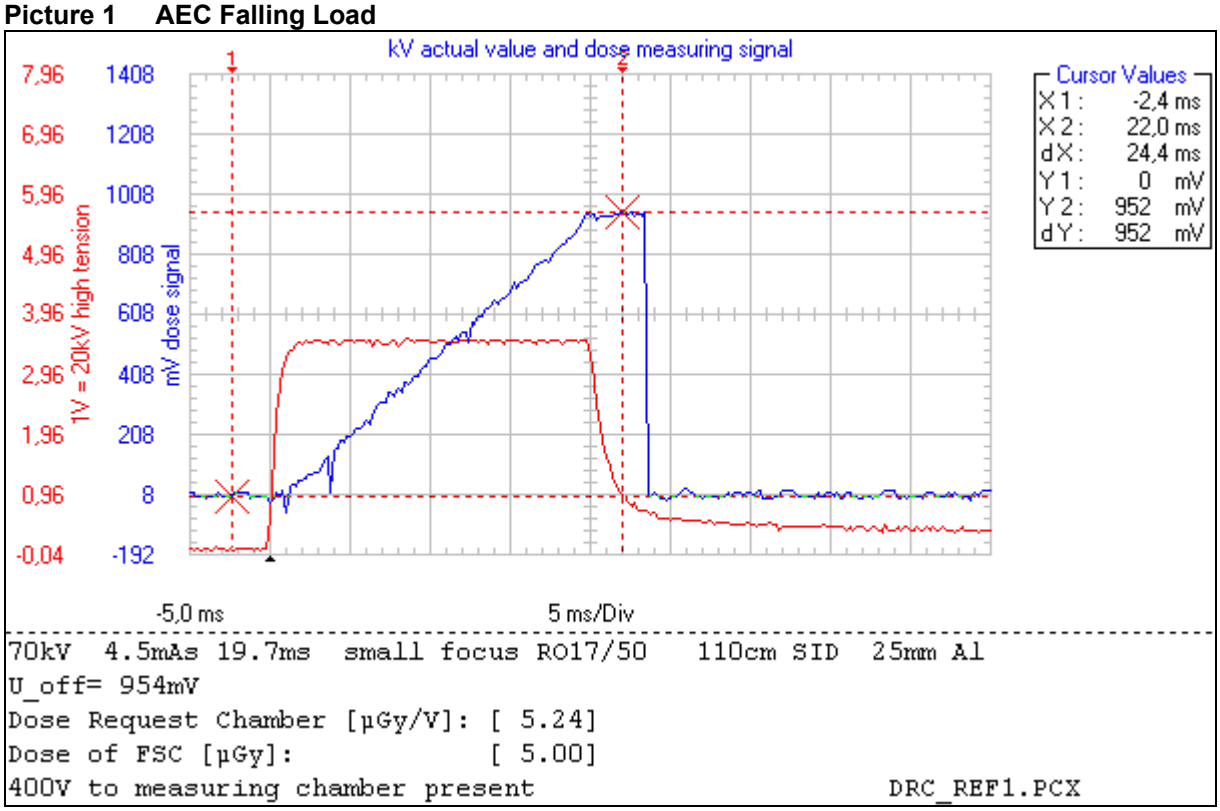
Attachment B

measuring chamber types

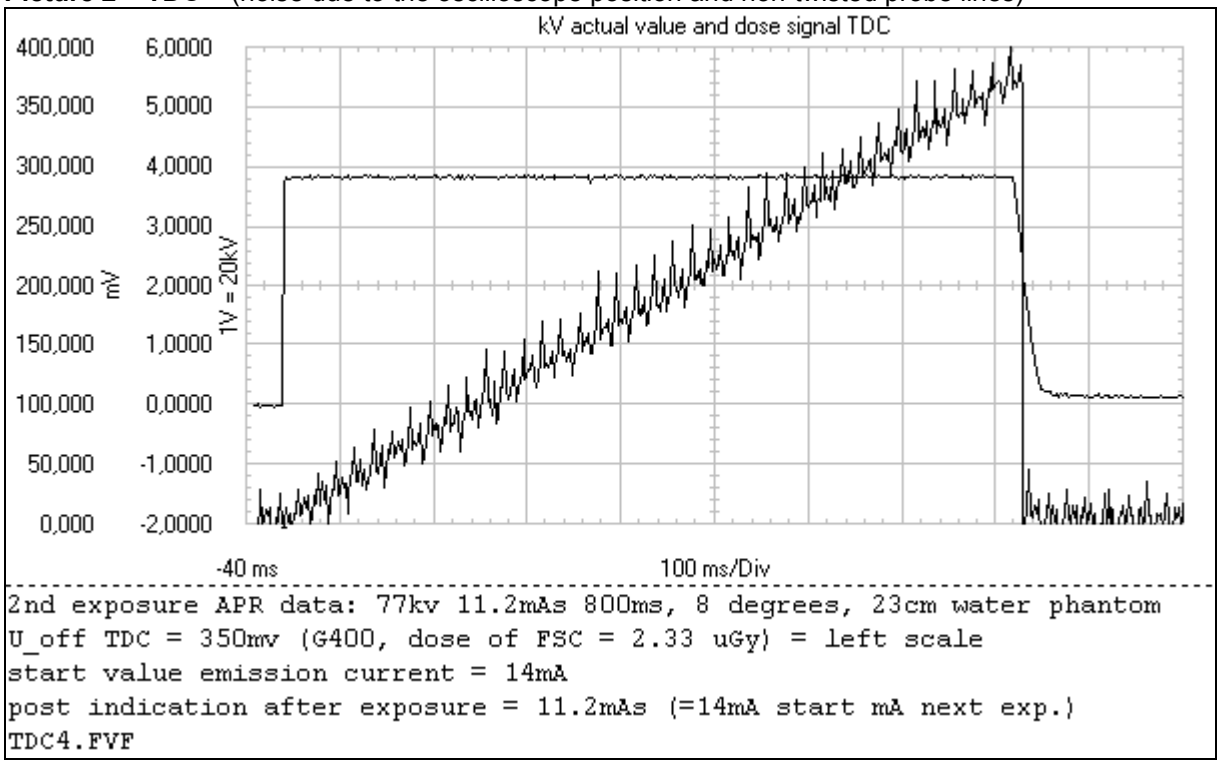
	name of data set	[µGy/V]	supply EZ150 W2/W3 15V / 40V
typical Hybrid	9803 509 . typ.Hybrid	5.85	only 40V
typical ALC	9890 000 ..1 typ.ALC Pb	5.24	15V or 40V
typical ALC	9890 000 ..2 typ.ALC Ag	5.24	15V or 40V
Bucky	9803 509 10002	5.85	only 40V
Bucky	9890 000 01611	5.24	15V or 40V
Bucky	9890 000 01612	5.24	15V or 40V
Bucky	9890 000 01613	5.24	15V or 40V
Bucky	9890 000 01614	5.24	15V or 40V
Childrens Bucky	9803 509 10102 Ch.Bucky	5.41	only 40V
Childrens Bucky	9890 000 01621 Ch.Bucky	4.81	15V or 40V
Childrens Bucky	9890 000 01622 Ch.Bucky	4.81	15V or 40V
Childrens Bucky	9890 000 01623 Ch.Bucky	4.81	15V or 40V
Chest	9803 509 50002 Chest	5.85	only 40V
Chest	9890 000 01661 Chest	5.24	15V or 40V
Chest	9890 000 01662 Chest	5.24	15V or 40V
Chest	9890 000 01663 Chest	5.24	15V or 40V
Scopomat 42/52	9803 509 30202 Scopo42/52	5.68	only 40V
Scopomat 42/52	9890 000 01651 Scopo42/52	5.08	15V or 40V
Scopomat 42/52	9890 000 01652 Scopo42/52	5.08	15V or 40V
Scopomat 42/52	9890 000 01653 Scopo42/52	5.08	15V or 40V
Scopomat 63/73	9803 509 30002 Scopo63/73	5.32	only 40V
Scopomat 63/73	9890 000 01631 Scopo63/73	4.81	15V or 40V
Scopomat 63/73	9890 000 01632 Scopo63/73	4.81	15V or 40V
Scopomat 63/73	9890 000 01633 Scopo63/73	4.81	15V or 40V
Scopomat 71/74	9803 509 30102 Scopo71/74	5.15	only 40V
Scopomat 71/74	9890 000 01641 Scopo71/74	4.63	15V or 40V
Scopomat 71/74	9890 000 01642 Scopo71/74	4.63	15V or 40V
Scopomat 71/74	9890 000 01643 Scopo71/74	4.63	15V or 40V
Neuro Diagnost	9803 509 50102 Neuro D.	8.06	only 40V
Neuro Diagnost	9890 000 01671 Neuro D.	7.14	15V or 40V
Neuro Diagnost	9890 000 01672 Neuro D.	7.14	15V or 40V
Neuro Diagnost	9890 000 01673 Neuro D.	7.14	15V or 40V
Cranio Diagnost	9803 509 50602 Cranio D.	8.06	only 40V
Cranio Diagnost	9890 000 01681 Cranio D.	7.14	15V or 40V
Cranio Diagnost	9890 000 01682 Cranio D.	7.14	15V or 40V
Cranio Diagnost	9890 000 01683 Cranio D.	7.14	15V or 40V
Puck 35x35	9803 509 60002 Puck 35x35	4.37	only 40V
Puck 35x35	9890 000 01691 Puck 35x35	3.94	15V or 40V
Puck 35x35	9890 000 01692 Puck 35x35	3.94	15V or 40V
Puck 35x35	9890 000 01693 Puck 35x35	3.94	15V or 40V
Extremities	4512 102 80261 Extremity	10.10	only 40V
Extremities	4512 104 47621 Extremity (9803 509 51202)	1.14	15V or 40V
Junior Diagnost	4512 103 06661 Junior D. (9890 509 51202)	3.32	only 40V
Junior Diagnost	4512 104 47621 Junior D. (9803 509 51202)	1.14	15V or 40V
Mammo Diagnost	4512 127 98802 MammD.	3.32	only 40V
Mammo Diagnost	4512 127 98803 MammD.	1.40	15V or 40V
Mammo UCBC	4512 104 18811 MamUCBC	3.32	only 40V
Mammo	4512 104 47621 Mammo (9803 509 51202)	1.40	15V or 40V

Attachment C

Picture 1 AEC Falling Load



Picture 2 TDC (noise due to the oscilloscope position and non-twisted probe lines)



Attachment D

APRMAN	XRGSCOPE **Change APR** - screen	explanations
APR Name	**APR name**	up to 16 characters
appears only in EXCEL Format	**APR number**	for the control handle Bucky TH assignment, external APR modules e.g. Scopomat
Focus small, medium, large, vario	**Focus** small, medium, large, vario	medium = no function vario = only with existing option
Vario Focus 20, 35, 50, 65, 80% of small	**Vario focus ratio** 20, 35, 50, 65, 80% small focus	portion (power related) of the small focus to vario focus
Field left	**Dose measurement field (left)**	at least one measuring field must be **on** to have AEC functionality to prevent AEC selection all fields must be **off**
Field middle	**Dose measurement field (middle)**	
Field right	**Dose measurement field (right)**	
preferred Technique automatic non automatic	**Preferred technique** Automatic Non automatic	
Automatic RAEC RAECF TDC	**AEC technique** AEC falling load kV AEC fixed current kV-mA TDC (Tomo Density Control)	A = Automatic E = Exposure C = Control F = Fixed current R = Radiographic
Manual RUIt RUQ RUQt	**No AEC technique** kV-mA-ms technique (RUIT) kV-mAs technique (RUQ) kV-mAs-ms technique (RUQT)	R = Radiographic U = kV I = mA Q = mAs t,T = ms
Ie Usage 1...100%	**Tube current max. factor [%]:** 1...100%	Ie = emission current the emission current should only be reduced for special applications, every kV stage has a different mA value
Patient Size Correction (steps at 6%) small U	**PSC U thin (dose equivalent steps):**	- kV correction at max 5 dose equivalent steps
Patient Size Correction (steps at 6%) large U	PSC U thick (dose equivalent steps):	+ kV correction at max 5 dose equivalent steps
Patient Size Correction (steps at 6%) small Q	**PSC Q thin (6% steps):**	- mAs correction at max 10 6% steps
Patient Size Correction (steps at 6%) large Q	**PSC Q thick (6% steps):**	+ mAs correction at max 10 6% steps
Patient Size Correction (steps at 6%) small D	**PSC density thin (6% steps):**	- density at max 10 6%steps
Patient Size Correction (steps at 6%) large D	**PSC dens. thick (6% steps):**	+ density at max 10 6%steps
U	**Exposure data U [kV]**	exposure kV within the programmed kV-min and kV-max limits
I	**Exposure data I [mA]**	emission current input only if kV-mA or kV-mA-ms techniques selected
Q	**Exposure data Q [mAs]**	mAs value input only if kV-mAs or kV-mAs-ms techniques selected

APRMAN	XRGSCOPE **Change APR** - screen	explanations
t	**Exposure data t [ms]**	exposure time input only if kV-mA-ms or kV-mAs-ms techniques selected, kV-mAs-ms recommended for Tomo
Density (Steps at 6%)	**Exposure data density (6%steps)**	individual APR density correction
Class of Film / Screen System Name Recommended Dose	**Film screen comb.**	online with the generator via **XRGSCOPE** one can select from all programmed FSC's, with **APRMAN** one gets only the FSC's which are assigned to APR if the data set was taken from the generator, non-assigned but existing FSC's must be programmed manually
Tomo No.	**Tomo number**	1...8 with decade adapter 1...16 with BuckyTH / TH2 and Digital Diagnost
Spectral Filter	**Spectral Filter**	only Galileo collimator: - no filter - 2 mm Al - 0.1mm Cu + 1 mm Al - 0.2mm Cu + 1mm Al
Fluoroscopy Curve	**Fluoroscopy curve**	selection out of 20 memories, these have to be loaded before with data sets

Attachment E

Optimus 50/65/80 R/F version
At auxilaries which are using DSI tomo with TDC (tomo density control) take care that the following settings are present to get a linear density voltage of 1 Volt:

Program:

- Registration devices
  - RGDV x
    - Data Set A:

Dose measurement input:.....EZX41
Dose measurement sensor type:.....Photo sensor/ampl. inp.

- Dose Rate Control
  - Amplimat
    - Chamber 5
      - **Data Set 1**
        <ESC>

Abbreviation:	[def1] <<<<	don't care
Dose Request Chamber [µGy/V]:	[6.40] <<<<	the content
Dose of FSC [µGy]:	[2.14] <<<<	of these fields
kV70-Char. U_0 [kV]:	[40]	
kV70-Char. Drel_0:	[**1.00**]	**<< the**
kV70-Char. U_1 [kV]:	[40]	
kV70-Char. Drel_1:	[**1.00**]	**<< fields**
kV70-Char. U_2 [kV]:	[50]	
kV70-Char. Drel_2:	[**1.00**]	**<< of the**
kV70-Char. U_3 [kV]:	[60]	
kV70-Char. Drel_3:	[**1.00**]	**<< kV**
kV70-Char. U_4 [kV]:	[70]	
kV70-Char. Drel_4:	[**1.00**]	**<< dependent**
kV70-Char. U_5 [kV]:	[80]	
kV70-Char. Drel_5:	[**1.00**]	**<< correction**
kV70-Char. U_6 [kV]:	[90]	
kV70-Char. Drel_6:	[**1.00**]	**<< factors**
kV70-Char. U_7 [kV]:	[110]	
kV70-Char. Drel_7:	[**1.00**]	**<< must**
kV70-Char. U_8 [kV]:	[130]	
kV70-Char. Drel_8:	[**1.00**]	**<< always**
kV70-Char. U_9 [kV]:	[150]	
kV70-Char. Drel_9:	[**1.00**]	**<< be at 1.00**
RLF t_0 [ms]:	[0]<<<<	don't
RLF Drel_0:	[1.000]<<<<	
RLF t_1 [ms]:	[20]<<<<	care
RLF Drel_1:	[1.000]<<<<	
RLF t_2 [ms]:	[60]<<<<	the
RLF Drel_2:	[1.000]<<<<	
RLF t_3 [ms]:	[100]<<<<	content
RLF Drel_3:	[1.000]<<<<	
RLF t_4 [ms]:	[500]<<<<	of
RLF Drel_4:	[1.000]<<<<	
RLF t_5 [ms]:	[1000]<<<<	the
RLF Drel_5:	[1.000]<<<<	
RLF t_6 [ms]:	[1500]<<<<	RLF
RLF Drel_6:	[1.000]<<<<	
RLF t_7 [ms]:	[2000]<<<<	fields
RLF Drel_7:	[1.000]<<<<	
RLF t_8 [ms]:	[3000]<<<<	
RLF Drel_8:	[1.000]<<<<	
RLF t_9 [ms]:	[4000]<<<<	
RLF Drel_9:	[1.000]<<<<	

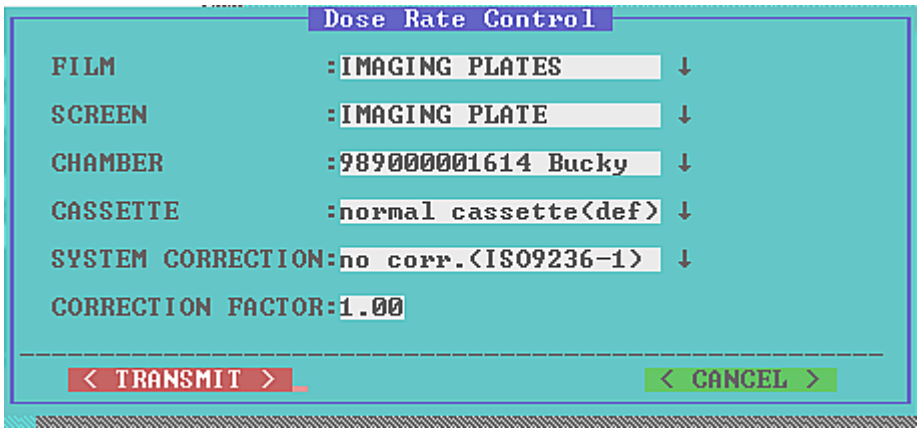
Attachment F

Computed Radiography, e.g. PCR or other imaging plates

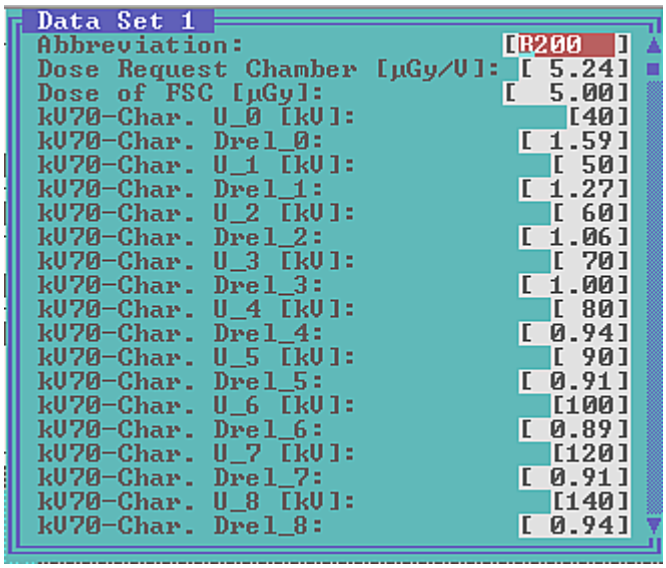
Dose Rate Control setting Optimus

Select:
Optimus (XRG90) or Optimus C >> Program >> **Dose Rate Control** >>
>> **AMPLIMAT** >> **Chamber 1...5 >> Data Set 1...5** >> **DRC Handling: Start Automatic DRC Processing** >> **<OK>**

FILM:	Select from	**FILM.TDL :**	**IMAGING PLATES**
SCREEN:	Select from	**SCREEN.TDL :**	**IMAGING PLATE**
CHAMBER:	Select from	**CHAMBER.TDL :**	the installed chamber type
CASSETTE:	Select from	**CASSETTE.TDL :**	**normal cassette(def)**
SYSTEM CORRECTION:	Select from	**SYSCOR.TDL :**	**no corr.(ISO9236-1)**
CORRECTION FACTOR:			**1.00**



Transmit the screen with **<F2>**.
Call the same Data Set **>> DRC Handling: Start Automatic DRC Processing >>** again**,** but now use **<ESC>** to open the data set screen:


Data Set 1
Abbreviation: [R200]
Dose Request Chamber [µGy/V]: [5.24]
Dose of FSC [µGy]: [5.00]
kV70-Char. U_0 [kV]: [40]
kV70-Char. Drel_0: [1.59]
kV70-Char. U_1 [kV]: [50]
kV70-Char. Drel_1: [1.27]
kV70-Char. U_2 [kV]: [60]
kV70-Char. Drel_2: [1.06]
kV70-Char. U_3 [kV]: [70]
kV70-Char. Drel_3: [1.00]
kV70-Char. U_4 [kV]: [80]
kV70-Char. Drel_4: [0.94]
kV70-Char. U_5 [kV]: [90]
kV70-Char. Drel_5: [0.91]
kV70-Char. U_6 [kV]: [100]
kV70-Char. Drel_6: [0.89]
kV70-Char. U_7 [kV]: [120]
kV70-Char. Drel_7: [0.91]
kV70-Char. U_8 [kV]: [140]
kV70-Char. Drel_8: [0.94]

Two data fields can be modified, all others **must not** be changed:

Abbreviation: Any name up to six characters can be given. The abbreviation name should indicate the programmed speed type if different speeds shall be used with the same imaging plates.

Dose of FSC [µGy]: Use $\mathbf{K_s}$ explanation this page. The value can be adapted to the local "density taste".

All other data (**kV70-Char.** and **RLF**) **must** remain as they have been calculated during the programming and loading process to obtain the chamber type + imaging plate depending kV characteristic. RLF is constant = 1.

Formula to determine the **speed = S** of a film-screen-combination:

$$S = \frac{K_0}{K_s} = \frac{\textbf{1000 µGy}}{\textbf{Dose of FSC [µGy]:}}$$

>> use speed as abbreviation >> name

!! S = speed **must not** be mixed up **!!**
!! with *S = sensitivity PCR* **!!**

K_0 is a constant with a value of 1000 µGy.

K_s is a variable value principally representing a switch off dose to obtain a density of 1.0 above base and fog, (normal films determined by the manufacturer of a film-screen system for defined processing conditions which are different in a computed RAD system). Can be adapted to the local "density taste"

If e.g. K_s = 5 µGy (like the example of the previous page)

$$S = \frac{1000\ \mu Gy}{5\ \mu Gy} = 200$$

Range of **speed values S** within the standard **speed class SC** systems:

only valid for film-screen-combinations for an optical density of 1.0		
Speed class **SC** Standard	dose / exposure [µGy] Standard class **SC**	Speed value **S** Range
6	167	5 - 9
12	83	10 - 18
25	40	20 - 36
50	20	40 - 71
100	10	80 - 140
200	5	160 - 280
400	2.5	320 - 560
800	1.25	630 – 1100
1600	0.625	1250 – 2200

If different speeds shall be used copy one screen with **<F3>** and load it to all other data sets of the chamber with **<F4>**. Change **Abbreviation** names and **Dose of FSC** values accordingly afterwards

More information available in booklet "Radiographic screens and films", manual order No. 4512 980 50592.

Attachment G

How to get the "=" characters attached to existing APR data sets which are copied from default data sets or the TH room next door?

There are EXCEL functions explained in the text. “English” and *“German”* function names appear together (other languages were not available).
Use the APRMANager.

- Load the original data APRxxx.TDL file from the disk or receive it from the generator.
- Save a received file in the appropriate release format (2 or 3 only, previous versions should not exist anymore).
- Export the APRxxx.TDL file to a xxx.CSV file (menu File).
- Start EXCEL.
- Load the just translated APRxxx.CSV (CSV = comma separated value) file.
- APR names appear at column G.
- Select column H with the right mouse button.
- Insert a new column.
- The previous content of column H moves to column I.
- Select field H2 (ignore header field H1, the “APR name” header string **must not** be modified).
- Select icon “Paste Function” *“Funktions Assistent”* [f_x] , in the screen “Paste Function” *“Funktion einfügen”* select “All” *"Alle”* at “Function category:” *“Kategorie:”* and “CONCATENATE” *“VERKETTEN”* at “Function name:” *“Funktion:”*.
- Enter “G2” in the “Text1” field (the name of G2 position appears on the right side of the Text1 field) and “=” in the “Text2” field of the “CONCATENATE” *“VERKETTEN”* field.
- Hit the “OK” *“Ende”* button of the screen. Now the APR name of field G2 appears in the H2 field with the additional “=” character.
- The modified name field carries a broad frame now, move the mouse to the right hand side bottom edge until the mouse sign changes to a “**+**”.
- Now push the left mouse button and pull the fields down until all APR are selected which have to get the “=” character.
- Select the modified fields of column H again and use the copy function <CTRL C>.
- Select the original fields of column G. Hit the right mouse button and select function “Paste Special” *“Inhalte einfügen...”*. Select “Values” *“Werte”* at options “Paste” *“Einfügen”* and leave “None” *“Keine”* at “Operation” *“Operation”*. All APR carry the “=” at the end of the string now.
- Select column H with the right mouse button and delete it.

- Carry out the same procedure at column K to attach "=" to the menu names and for submenus at other columns where present.
- Save the file. Start APRMANager. Import the modified xxx.CSV file.
  During import APRMAN checks if there are any faults. Close the “Assign RGDV” screen and minimize the screen. Now you see a Test Editor screen. The most common entry in this editor will be the length of the APR name string. It should not be longer than 16 characters. With the additional “=” some of the names will increase the value, e.g. “Dens axis F”, as the F indicating fixed current technique is at position 16 in the default APR data sets. Such individual APR can easily be repaired. Just select the and delete one of the “space” characters.
- Save the imported CSV file as release 2 or 3 TDL file and load it to the generator.